Geological Circular 72-1

Mineral Deposits in the West Chinati Stock, Chinati Mountains, Presidio County, Texas

BY
WILLIAM N. McANULTY, SR.

BUREAU OF ECONOMIC GEOLOGY
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W. N. McAnulty, Sr.[1]

ABSTRACT

The West Chinati stock, well exposed in San Antonio Canyon and immediately westward on slopes of the southwestern part of the Chinati Mountains, Presidio County, Texas, is a large stock-like body of porphyritic hornblende granite cut by numerous dikes and irregular-shaped plutons of rhyolite, rhyolite porphyry, microgranite, trachyte porphyry, diorite, and igneous breccia.

Fissure veins developed in wide and long sheeted zones which strike E-W and N. 50° E. contain potentially commercial deposits of lead-zinc-silver-fluorspar minerals including galena (PbS), sphalerite (ZnS), argentite (Ag_2S), cerargyrite ($AgCl$), and fluorite (CaF_2). Minor amounts of chalcopyrite ($CuFeS_2$) and oxidized copper minerals also occur in the fissure vein deposits.

Marginal bodies of rhyolite, rhyolite porphyry, and trachyte porphyry contain disseminated copper mineralization and possibly host commercial porphyry-type copper deposits.

INTRODUCTION

This report gives results of a reconnaissance study, made during the summer of 1969, of the West Chinati stock located in the Chinati Mountains, which extend southeastward from Pinto Canyon to Shafter, a distance of approximately 18 miles, in south-central Presidio County, Texas (fig. 1). The San Antonio Canyon area, where the stock is well exposed, may be reached by travelling 20 miles northwestward from Presidio on F-M Road 170, thence northward on a dirt road to the Mesquite ranch headquarters, and thence northwestward over a rough ranch road for 7 miles. The 1959 U. S. Geological Survey Presidio topographic sheet NH 13-8, scale 1:250,000, covers the area.

Very little geological work or prospecting was done in the San Antonio Canyon area prior to this study because during a period of about 25 years entry to nearly all geologists and prospectors was refused by owners of the Mesquite ranch. Doctoral studies by Rix (1953) and by Amsbury (1957) dealt briefly with portions of the area, but, since those investigations were concerned primarily with stratigraphy, little attention was given to the geology of the West Chinati stock and its economic mineral potential.

Some small-scale mining and prospecting were done before the area was "withdrawn" by the owners of the Mesquite ranch. Old workings in the northeast portions of San Antonio Canyon are believed to have been made circa 1900, with silver probably being the metal sought. The Burney mine (Canyon mine) west of San Antonio Canyon probably was first prospected for silver and gold about 1890. A 200-foot shaft and a short adit were developed during the late 1930's and early 1940's. The Burney property was examined by engineers of the U. S. Bureau of Mines in March 1943 and again in October 1944. In July 1944, the U. S. Geological Survey mapped the Burney claims. The U. S. Bureau of Mines diamond core drilled 1,742 feet in six holes on the Burney claims in 1946 (Dennis, 1947).

ACKNOWLEDGMENTS

This paper is based on a study financed by Mr. Ford D. Albritton, Jr., Bryan, Texas, and is published with his permission. Assistance in the field was given by W. N. McAnulty, Jr., Robert B. Smith, Robert Limon, and James Abshier. Thin sections were studied by Dr. Jerry M. Hoffer, of the Department of Geological Sciences, The University of Texas at El Paso. The work could not have been done without the generous help and cooperation of Mr. Tucker White, one of the owners of the Mesquite ranch.

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[1] Department of Geological Sciences, The University of Texas at El Paso.

PHYSIOGRAPHY

The Chinati Mountains are in the Mexican Highlands section of the Basin-and-Range Province, where fault-block mountain ranges stand high above adjacent alluvium-filled basins. The highest point in the study area, Chinati Peak, is 7,730 feet above sea level; total relief exceeds 3,500 feet. Mountain slopes are cut by numerous arroyos and steep canyons, and broad alluvial fans and pediments flank the mountains at an average elevation of about 4,000 feet.

Four-wheel drive vehicles are required to get over the few roads that exist in San Antonio Canyon and along the base of the mountain slope west of San Antonio Canyon. Most of the area is accessible only on foot or horseback.

The average annual rainfall is about 10 inches, and the mean annual temperature is 65° F. Winters are mild with little or no snow, and summers are hot. Vegetation on the mountain slopes consists of native grasses scattered among boulders, yucca, cacti, and a few pinons and junipers. Cacti, yucca, ocotillo, greasewood, and thorny shrubs grow sparsely in arroyos and on the pediment slopes.

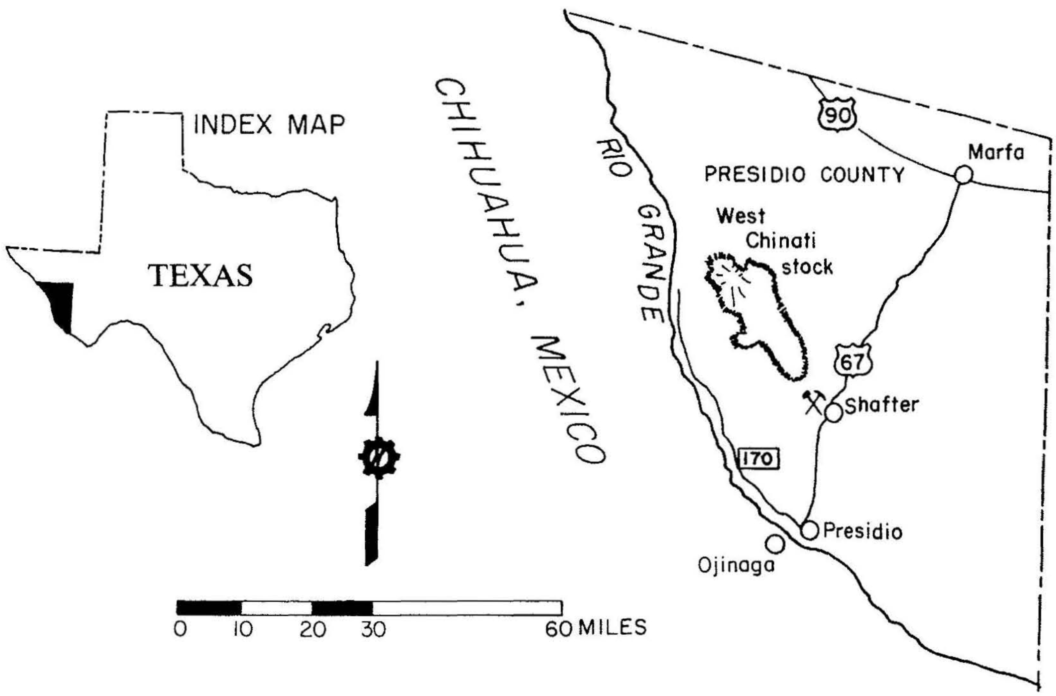

FIG. 1. Map showing location of West Chinati stock.

GEOLOGY

CHINATI MOUNTAINS

The Chinati Mountains are situated near the eastern margin of the Mexican geosyncline, or Chihuahua trough. The Coahuila peninsula, a promontory which affected sedimentation in the Mexican geosyncline during Jurassic and Cretaceous time, extended southeastward into Mexico from the present site of the Chinati Mountains. Permian strata in the area of the Chinatis were laid down in the Marfa basin.

Post-Cretaceous uplift, doming, normal faulting, and folding were followed by deep erosion of the Pennsylvanian, Permian, and Cretaceous rocks. Early to Middle Tertiary volcanism produced a volcanic plateau which was elevated and deformed by the emplacement of late Tertiary igneous bodies. Final deformation occurred during late Cenozoic when northwest-trending Basin-and-Range block faulting produced the horst block which constitutes the Chinati Mountains. Dissection of the mountain block has exposed late Paleozoic and Mesozoic sedimentary rocks around the margins of the core of intrusive and volcanic rocks. Thick bolson sediments, step-like gravel terraces, and thick fanglomerates lap against the lower slopes of the mountains on the west and extend over a large area in the Presidio basin.

INTRUSIVE BODIES

Two large intrusive bodies, the so-called West Chinati and South Chinati laccoliths, produced gentle anticlines and synclines in the Tertiary volcanics. Basin-and-Range normal faults left a northwest-trending block standing as a high horst. A major fault bounding the block on the west (a segment of the Texas Lineament (?)) has displacement of 2,500 to 3,000 feet; approximately the same amount of displacement is estimated for a delimiting fault at the east end.

The South Chinati laccolith (?), composed largely of porphyritic alkali granite, underlies the southeastern end of the range. Emplacement of this body deformed Permian and Cretaceous strata (well exposed in the Shafter area), and late hydrothermal fluids produced mineral deposits (Pb, Zn, Ag) in voids and brecciated zones along faults and fissures and in beds susceptible to replacement in Permian strata.

A thick succession of volcanic rocks occupies the middle segment of the mountains, between the South Chinati and West Chinati "laccoliths." As the West Chinati intrusion crops out over an area about 7 x 6 miles, and a floor is nowhere exposed, "stock" is the preferred designation. Outcrops of this body make nearly all of the surface over the west end of the mountains. The West Chinati stock is composed largely of porphyritic hornblende granite; however, it is cut by numerous dikes and irregular-shaped bodies of rhyolite porphyry, trachyte porphyry, diorite, micrograni te, and igneous breccia, and, at many places, it hosts considerable amounts of lead, zinc, silver, copper, and fluorite mineralization.

Emplacement of the West Chinati stock and satellitic bodies appears to have been the last igneous event in the area. A wide and deep re-entrant, San Antonio Canyon, across the southeastern edge of the stock exposes the stock over a large area to a depth of several hundred feet. San Antonio Canyon and the southwest slopes of the mountains developed on the West Chinati stock west of San Antonio Canyon are the areas with which this study is concerned.

WEST CHINATI STOCK

Chinati Peak is capped by lava flows of the Chinati Group, which cover the middle segment of the range. The contact between the West Chinati stock and the older, overlying lava flows is exposed in upper San Antonio Canyon at an elevation of about 6,500 feet. The contact dips eastward in that area. All volcanics have been eroded from the stock in the area west of Chinati Peak. The contact between the stock and sedimentary country rock is obscured along the southwest side of the mountains by alluvial fans and bolson sediments. Roof pendants and/or xenoliths of Cretaceous and Paleozoic limestones are exposed in two areas. Contacts between the stock and Cretaceous and Permian strata are exposed in Pinto Canyon and around the west end of the mountains.

The West Chinati stock is essentially porphyritic hornblende granite. The rock is holocrystalline, porphyritic to inequigranular, with phenocrysts (25 percent) consisting of groups of intergrown crystals plus individual crystals averaging 3 mm. The groundmass is subhedral to anhedral, averaging 0.7 to 1.0 mm. K-feldspar makes up about 50 percent of the rock; most of the phenocrysts and phenocryst masses are K-feldspar, as are many of the groundmass crystals. The groundmass shows more alteration than the phenocrysts. Oligoclase makes up about 17 percent of the rock, mostly as subhedral groundmass but also as phenocrysts. Quartz, in anhedral groundmass crystals and as an intergrowth with K-feldspar, constitutes about 15 percent of the rock. Hornblende makes up approximately 10 percent of the rock, occurring as subhedral groundmass crystals, usually appreciably altered to magnetite and other iron oxides. Minor amounts of pyroxenes (?) occur in clusters. Anhedral crystals and irregular masses of magnetite, which also include pyrite and chalcopyrite, make up about 8 percent of the rock. Accessory minerals include apatite and zircon.

The porphyritic hornblende granite is highly weathered on outcrops on slopes and canyon floors. Divide areas are commonly capped by a more resistant, finer grained porphyritic granite—a hood zone (?). Beneath the protective "hood," the more typical stock rock commonly displays intensive spheroidal weathering.

Dikes and plutons.—The stock is cut by numerous large and small, regular- and irregular-shaped dikes and plutons. Dike-like bodies of microgranite, ranging from a fraction of an inch to several tens of feet in thickness, are common. This dike rock is holocrystalline and inequigranular, with crystals ranging from 0.5 to 0.8 mm. Its principal constituent is K-feldspar (65 percent); which is generally subhedral and moderately altered to kaolinite and sericite. Quartz makes up 20 percent of the rock, being generally anhedral between feldspars. Plagioclase (5 percent) is subhedral and mostly altered to kaolinite and sericite. Mafics, about 10 percent of the rock, consist largely of hornblende and a minor amount of biotite highly altered to chlorite and iron oxides. Some magnetite, mostly altered to other iron oxides, is present. Some of the amphibole shows the blue to gray pleochroism of riebeckite.

Dikes and irregular-shaped bodies of rhyolite porphyry, trachyte porphyry, and multi-rock-type igneous breccias occur around the margins (?) of the stock. Some are strongly leached and should be explored for deposits of copper minerals. A body of rhyolite porphyry located low on the southwest side of the mountain (sections 122 and 171, fig. 7) contains oxidized copper minerals. This rock contains phenocrysts of K-feldspar, plagioclase, and quartz, which total about 10 percent of the rock. K-feldspar makes up about 70 percent and plagioclase from 5 to 25 percent of the phenocrysts. The phenocrysts are set in a fine-grained groundmass which is composed of perthitic K-feldspar, quartz, and minor plagioclase, along with a small amount of magnetite; alteration products include calcite, clay minerals, and iron oxides.

Trachyte porphyry crops out over a sizable area immediately east of the outcrop of rhyolite porphyry described above. Phenocrysts of K-feldspar make up 15 to 20 percent of this rock. The groundmass is very fine grained and composed largely of K-feldspar and minor quartz. Intrusive breccia composed of a variety of igneous rock types appears to intrude the trachyte porphyry. Small outcrops of diorite (?) were observed in a few places.

MINERAL DEPOSITS IN THE WEST CHINATI STOCK

MINERALIZATION

Mineralized veins are common in well-developed sheet zones formed by closely spaced parallel joints trending E-W and N. 50° E. These zones weather more easily and produce saddles across divides and summits, and the topographic expression of some of the sheeted zones extends more or less continuously for more than 2 miles.

Two types of ore deposits are favored in the West Chinati stock: (1) fissure veins containing lead, zinc, silver minerals, and fluorite, and (2) strongly leached marginal bodies of rhyolite porphyry and other silica rocks and breccias which may contain commercial deposits of disseminated copper minerals.

FISSURE VEINS

Veins in the jointed or sheeted zones contain galena (PbS), sphalerite (ZnS), minor chalcopyrite (CuF_2S_2), pyrite (FeS_2), cerargyrite (AgCl), argentite (Ag_2S), fluorite (CaF_2), quartz, and manganese and iron oxides.

Prior to 1942, there was sporadic small-scale mining and prospecting on lead-zinc-silver-fluorite veins in the West Chinati stock in four areas: (1) the San Antonio Canyon "mine"; (2) the Burney "mine"; (3) the Hillside adit; and (4) the Rock House area (fig. 7). Interesting mineralization occurs in several other areas, including the fluorspar prospect and the Corral area (fig. 7).

San Antonio Canyon "mine."—Several old workings located in the northeastern part of San Antonio Canyon are included under the heading of San Antonio Canyon "mine" (fig. 2). Numerous adits, shafts, and exploratory pits in this area indicate activity over a period of several years. It is believed that the work was done around 1900.

The workings are located on several E-W veins. None of the adits or shafts is accessible at the present time. A grab sample from one of the larger dumps assayed 8.25 ozs of silver; a selected "high-grade" sample contained 58.4 ozs of silver. Fluorite, quartz, and altered country rock (porphyritic hornblende granite) apparently make up the bulk of the gangue. Small amounts of galena and sphalerite were observed on the dumps. In the few places where veins are well exposed, the ore minerals occur in narrow, interlacing (stockwork) veinlets in altered zones ranging from 2 to 30 feet in width. Several dikes of rhyolite, rhyolite porphyry, and porphyritic microgranite cut the stock rock in the area of the San Antonio Canyon "mine." The generally north-trending dikes are cut by E-W veins. Most of the veins in this area are thin and weakly developed. Commonly, argillic alteration borders a central stockwork zone.

Burney "mine."—The strongest mineralization observed in the West Chinati stock is in the Burney vein, in and near the Burney "mine," in section 38, block 60, G. S. & S. A. Ry. Co. survey (fig. 7). This area may have been prospected for gold and silver in the 1890's. The first production, 1.5 tons of silver chloride and 2.5 tons of lead ore, was in 1935 by E. L. Burney; Robert I. Carr shipped 5.5 tons of Pb-Zn-Ag ore in 1942. No shipments were made after 1942.

The Burney vein is in an E-W sheeted zone in porphyritic hornblende granite. Slickensides exposed in the workings indicate that some left lateral strike-slip movement occurred. The vein is nearly vertical near the surface but drilling revealed that it dips southward at depth. A late dike of microgranite parallels and, in places, cuts the vein.

The workings consist of the following (figs. 3 and 4):

1. An 8' x 8' vertical shaft, reported to be 200 feet deep. It is now filled with water to a level about 20 feet below the surface.
   a. A short crosscut to the vein on the 100-foot level, and drifts 60 feet east and 15 feet west on the vein.
   b. A short crosscut to the vein on the 200-foot level, and a 115-foot drift westward on the vein.
2. A 125-foot adit on the vein, with a raise to the surface, driven into the hillside about 180 feet west of the shaft.
3. A few trenches east of the shaft on the projected strike of the vein, and several trenches and test pits on the vein west of the adit.
4. An adit (inaccessible) about 4,000 feet west of the shaft.

The U. S. Bureau of Mines in 1946 drilled six diamond-core holes near the shaft for a total of 1,742 feet and sampled the old workings (Dennis, 1947).

The Burney vein can be traced easily for about 3,000 feet west of the shaft, and a suggestive topographic expression of it extends on westward for another 2,000 feet. The vein does not crop out eastward from the shaft, but a conspicuous topographic lineation (swath) can be traced eastward from the shaft across San Antonio Canyon and into

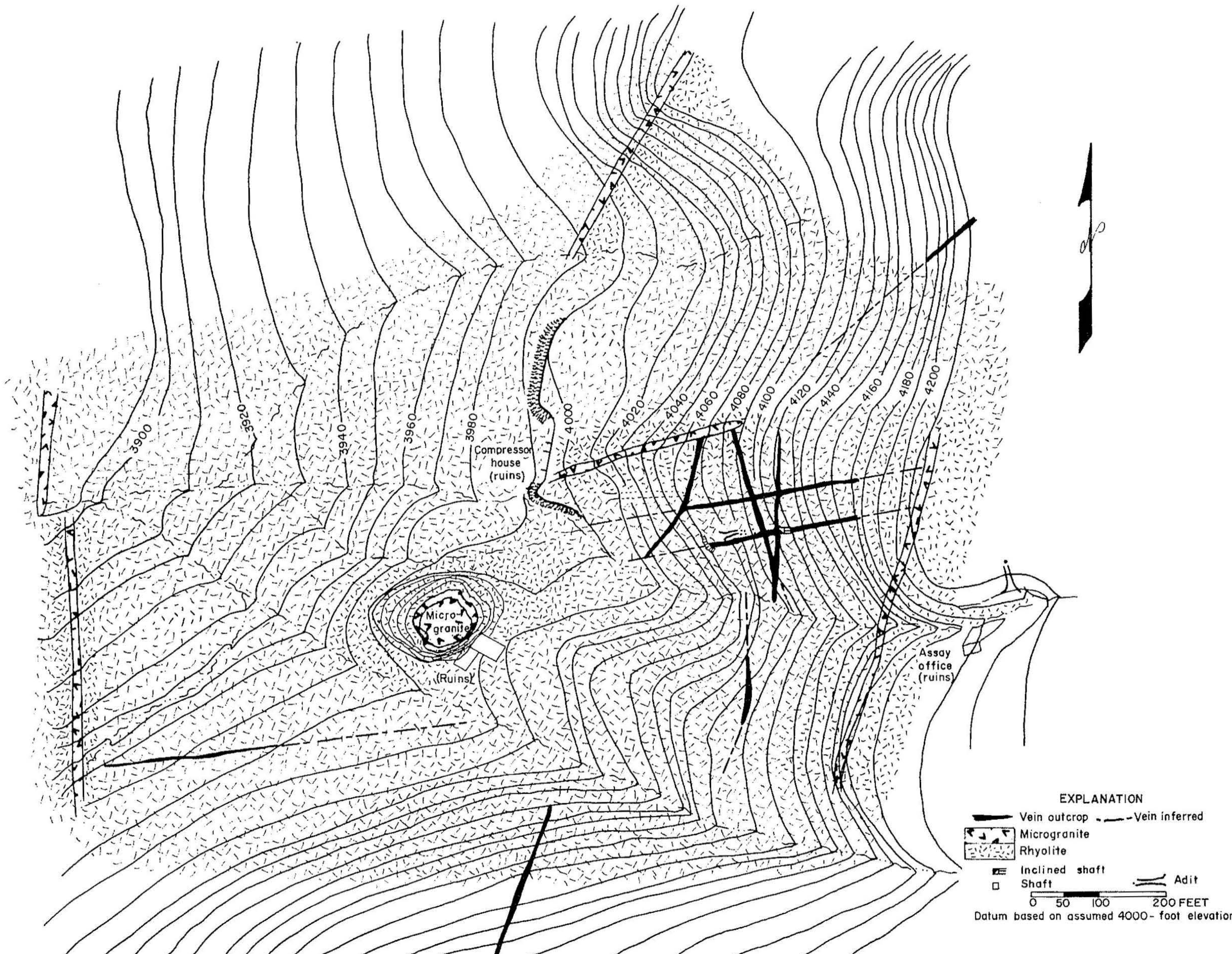

FIG. 2. Geologic map (alidade survey) of San Antonio Canyon "mine."

the area of the San Antonio Canyon "mine"—a distance of about 2 miles. The vein appears to be developed best along the segment between the shaft and the crest of a hill approximately 2,500 feet to the west. It varies on the outcrop from 1 to 25 feet in width along this segment.

The ore minerals include steel-gray galena (PbS), yellow and black sphalerite (ZnS), cerargyrite (AgCl), argentite (?) (Ag_2S), minor chalcopyrite ($CuFeS_2$) and oxidized copper minerals (malachite, azurite, and chrysocolla), and fluorite (CaF_2). The gangue minerals are quartz, pyrite, minor hematite and barite, and altered country rock. In most places there is a 1-to-2-foot gouge zone along the footwall and a thinner gouge zone along the hanging wall. The ore minerals are iron-stained and the galena and sphalerite are partially oxidized in the adit. Core from the 100-foot level showed incipient oxidation of galena and sphalerite. However, pyrite in core from 300 feet below the level of the adit was oxidized.

Nine samples from the adit, collected and analyzed by the U. S. Bureau of Mines, averaged 1.92 percent Pb, 1.65 percent Zn, 9.01 percent CaF_2, and 1.78 ozs Ag (Dennis, 1947, p. 4). A grab sample collected during the present study from a test pit dump west of the adit contained 6.85 ozs Ag.

The mineralization in the Burney vein is irregular and poddy and is the result of both replacement and void filling. The strongest mineralization is in brecciated zones. Breccia clasts include country rock and some "jasperoid-like" material. Brecciation was followed by quartz void filling and crustification. The paragenetic sequence appears to have been as follows:

Brecciation ————
Quartz ————
Hematite ————
Galena ————
Sphalerite ————
Dike (microgranite) ——
Fluorite ————

Most of the fluorite is in veins and veinlets ranging from an inch or less to 3 feet in thickness. The fluorite veins pinch and swell and are discontinuous. Pod-like masses of fluorite are present, and brecciated zones containing galena and sphalerite are fluoritized in places. The fluorite veins contain nearly pure, coarsely crystalline fluorite, much of which is light to dark green. The known fluorspar could not be produced profitably except as a co-product with the metallic ores. The thicker zones might be profitably hand sortable, but

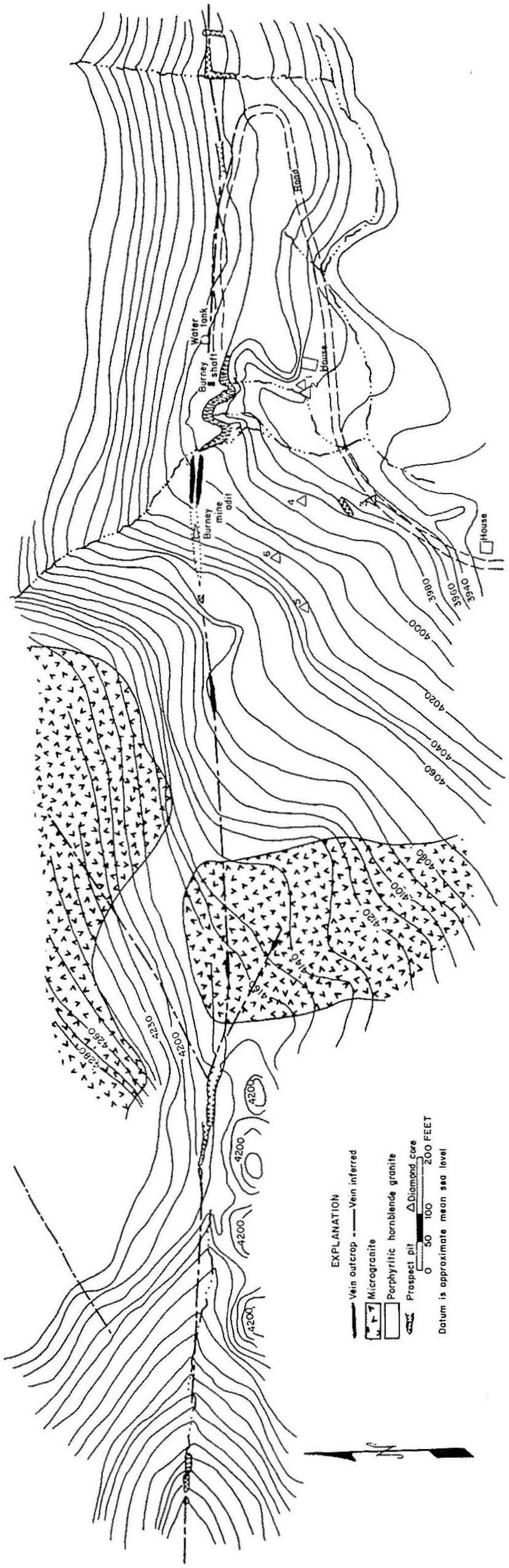

FIG. 3. Geologic map (alidade survey) of Burney "mine" area.

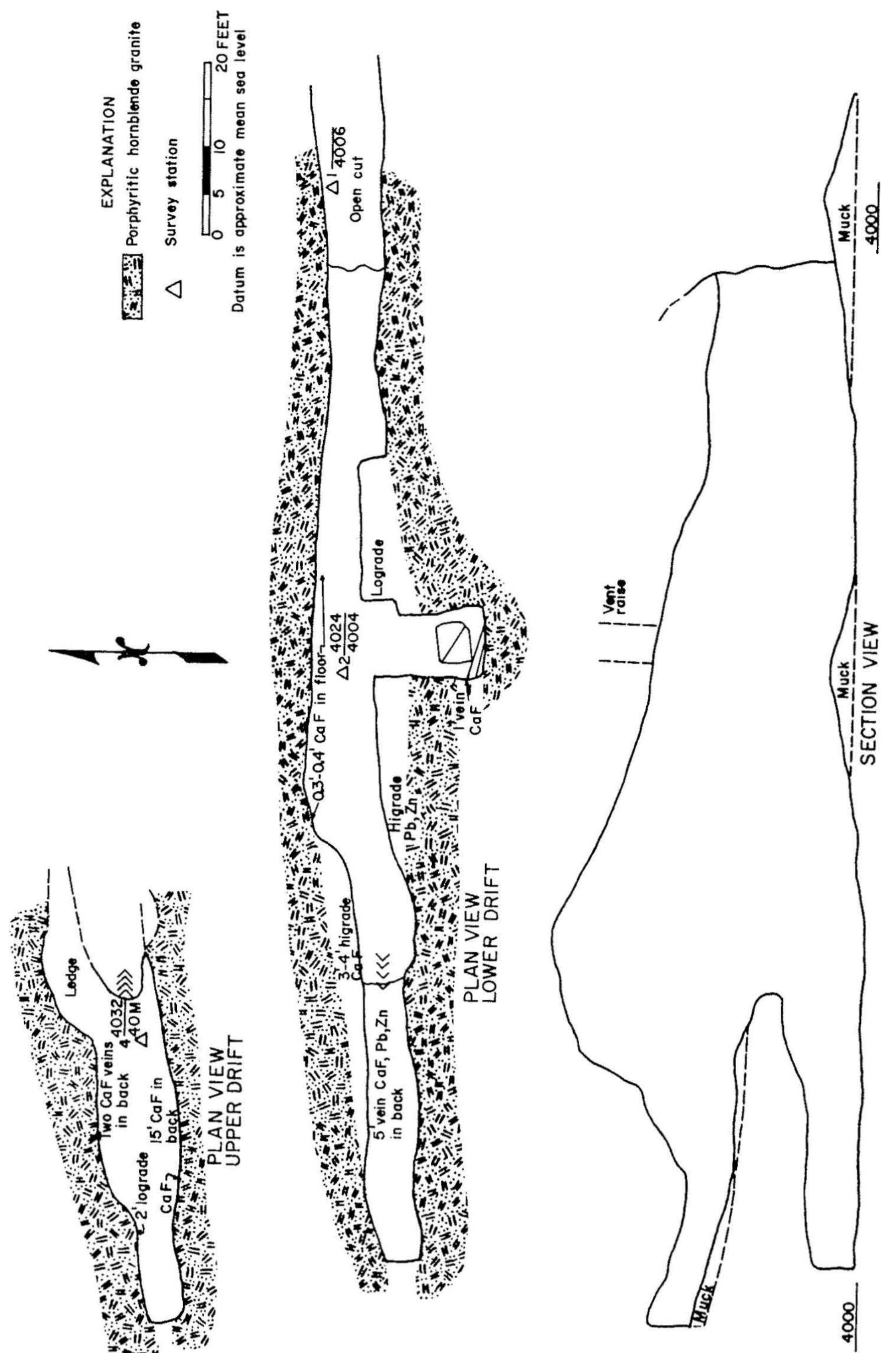

FIG. 4. Brunton and tape survey of Burney "mine."

recovery of any commercially significant amount of fluorspar will require flotation milling.

Hillside adit.—The Hillside adit is located on a strong E-W vein in section 119, about ¾ mile northeast of the Burney "mine" (figs. 5, 6, and 7). It is high on the west slope of San Antonio Canyon and is accessible only on foot or horseback. Old workings consist of an adit 135 feet long and an inclined (75°) winze for a distance of 125 feet below the adit floor, with a short drift in each direction on the vein at the bottom of the winze.

The Hillside vein cuts porphyritic hornblende

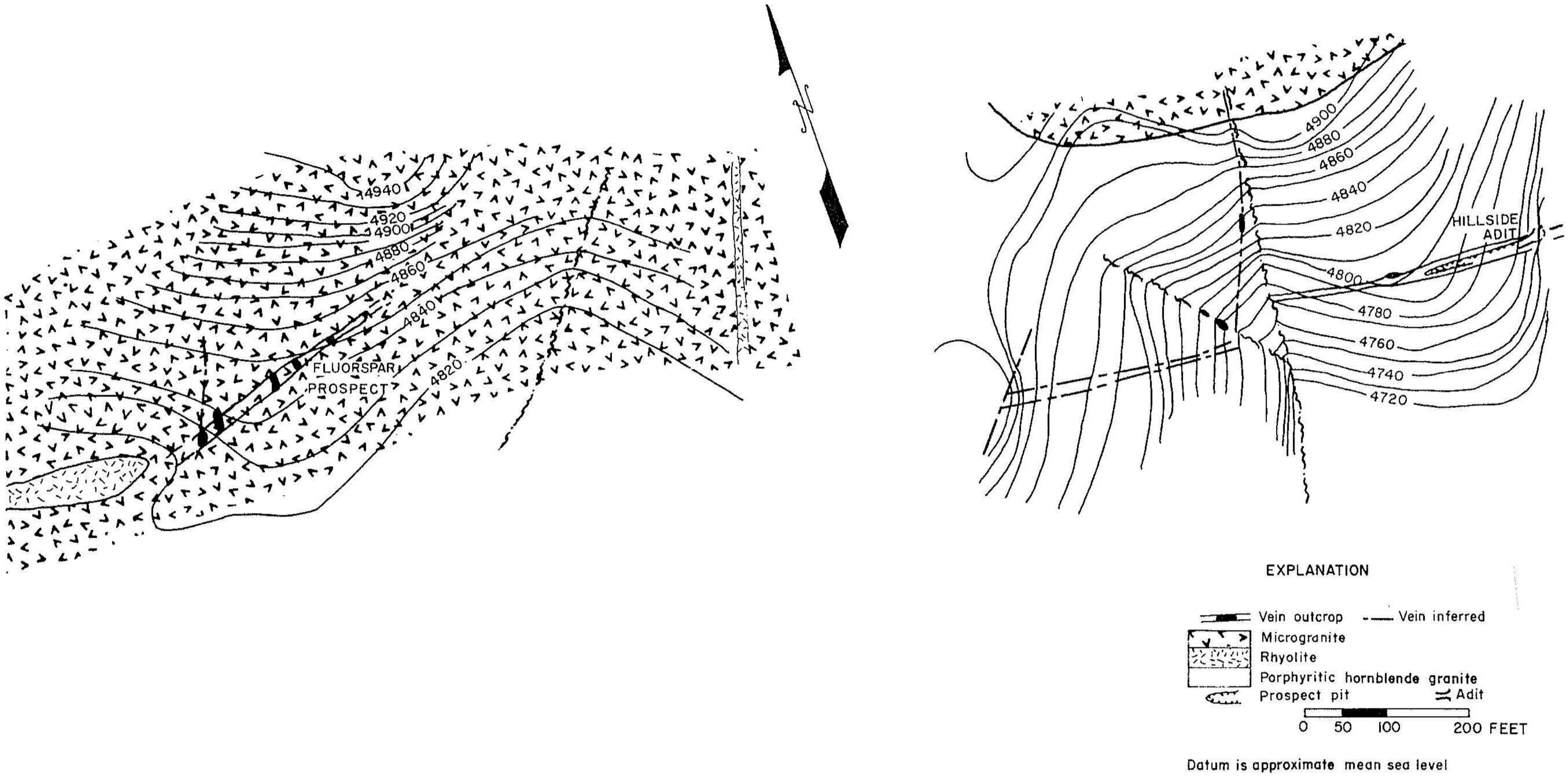

FIG. 5. Geologic map (alidade survey) of Fluorspar prospect and Hillside adit.

granite and is generally similar to the Burney vein, but some differences are notable: (1) Brecciation, so prominent in the Burney vein, is absent in the Hillside vein; (2) crustified quartz veining is absent in the Hillside vein; (3) the Hillside vein contains less galena, sphalerite, and hematite than the Burney vein; and (4) the Hillside vein has a flatter dip than the Burney vein. The Hillside vein varies from 3 to

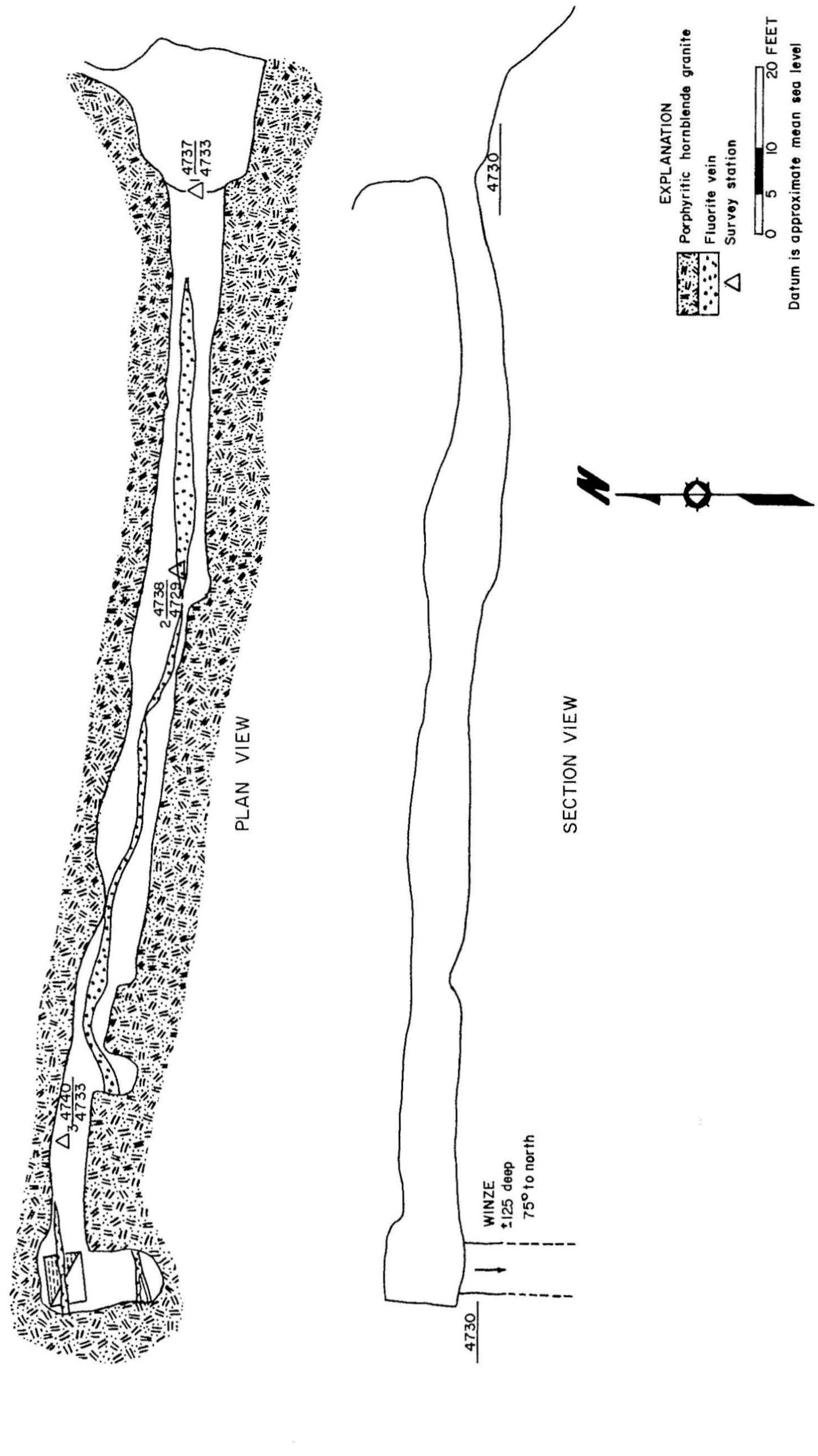

FIG. 6. Brunton and tape survey of Hillside adit.

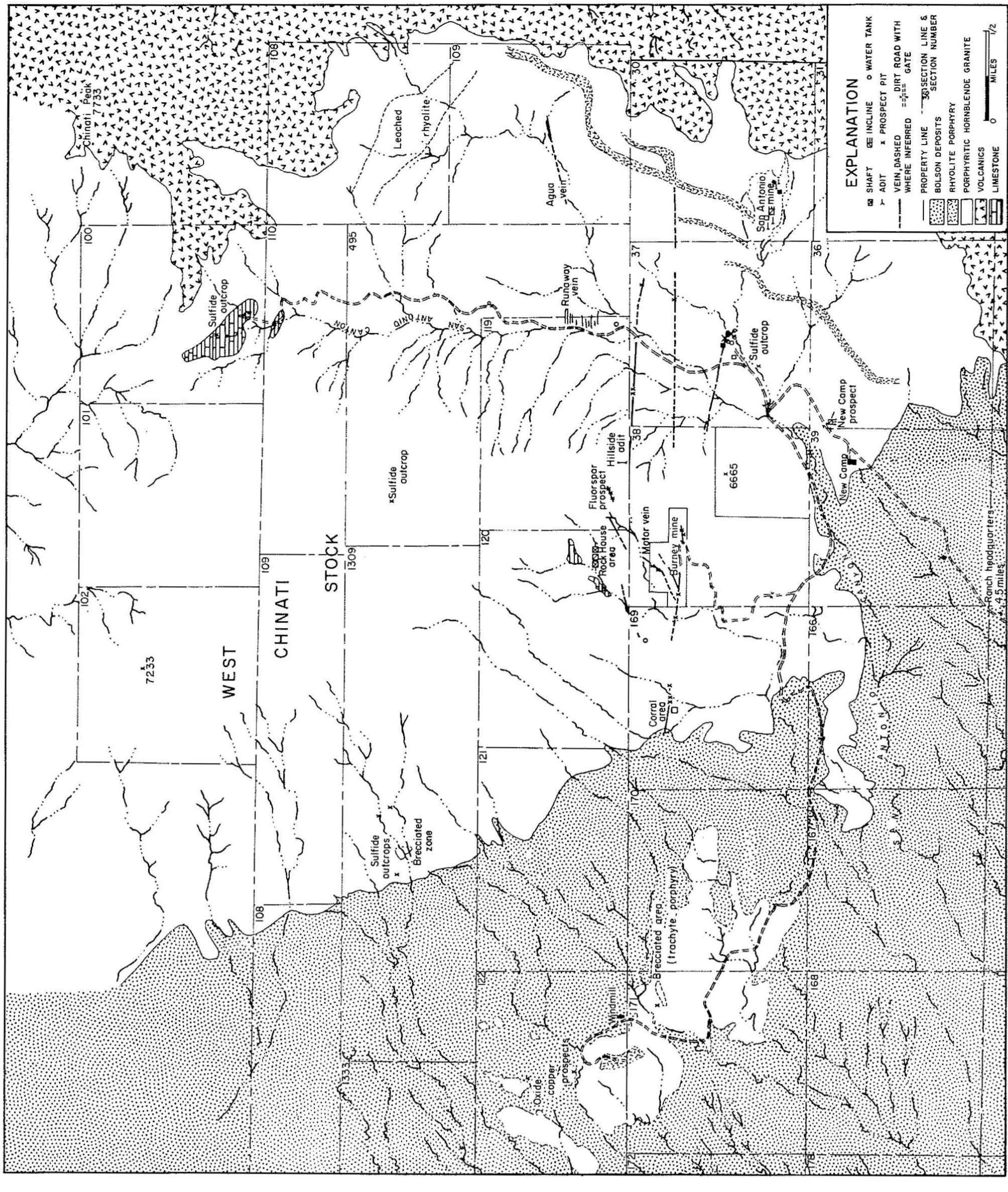

FIG. 7. Geologic map of West Chinati stock.

30 feet in width or thickness.

That part of the vein exposed in the adit contains a persistent seam of coarse-grained fluorite near the footwall. This seam pinches and swells, ranging from 4 to 30 inches in thickness. An irregular dike of partially altered microgranite is present along the hanging wall side. Stockwork veinlets of limonite lace the wall rock on the footwall side.

At a point in the adit 107 feet from the portal the vein branches or widens and a second fluorite seam comes in. Apparently the adit followed the weaker of the two fluorite veins, as at the end of the adit, where the winze is located, a crosscut exposes the principal vein a few feet to the south. The winze followed a thin fluorite vein.

Cerargyrite is moderately abundant near the adit portal, intermingled with small amounts of galena and sphalerite. A grab sample taken from an old pile of "ore" contained 20 ozs of silver. The fluorite is pure, coarsely crystalline, and mostly green in color.

The Hillside vein is traceable for more than a mile eastward and several hundred feet westward from the adit. The area immediately west of the adit appears to be strongly mineralized.

Fluorspar prospect.—The Fluorspar prospect is about 1,500 feet northwest of the Hillside adit, in section 119 (figs. 5 and 7). It is accessible only on foot or horseback. Fluorite occurs in a vein which strikes N. 50° E. and crops out in a topographic saddle for about 300 feet. Pure, green, coarsely crystalline fluorite in veins ranging from 4 to 30 inches in thickness has been exposed in several shallow test pits spaced along the outcrop. The vein zone, more than 20 feet wide, is made up largely of altered porphyritic hornblende granite. Sulfide minerals are scarce, but a sample of dark-colored vein material taken from one of the test pits contained 3.8 ozs of silver, and traces of galena and sphalerite were observed. This vein should be explored to depths of 500 to 1,000 feet to determine the fluorspar potential.

Corral area.—Two well-developed fissured zones intersect near a corral located about 1 mile west of the Burney "mine," in section 169 (fig. 7). The Burney vein (?) and a strong vein striking N. 50° E. intersect in this area. The stock rock (porphyritic hornblende granite) is strongly altered in the veins and contains small amounts of sulfides, fluorite, and quartz.

Fissure veins in other areas.—Fissure veins are numerous and well exposed at several places in San Antonio Canyon. Among the more interesting of these are the Agua vein, the Runaway vein, and the New Camp vein (fig. 7). Some sulfide mineralization shows in outcrops of all of these veins.

DISSEMINATED COPPER MINERALIZATION

Oxidized copper minerals (chrysocolla, malachite, and azurite) are abundant in an altered rhyolite porphyry pluton located in sections 122 and 171. The copper mineralization is associated with a silicified zone which strikes northwest and crops out at intervals over a distance of 2,500 feet. The rhyolite porphyry body cuts the West Chinati stock near its outer margin (?). Small bodies of diorite intrude the rhyolite porphyry. The copper mineralization is well exposed to depths of 10 to 15 feet in two test pits; it is also exposed in several shallower pits.

Oxidized copper mineralization occurs in a narrow zone in a trachyte porphyry pluton located about ¾ mile east of the occurrence mentioned above. The trachyte porphyry mass is cut by intrusive breccia composed of a variety of igneous rock types. The breccia outcrop covers more than 100 acres.

A large, leached, dike-like body of rhyolite on the northern margin of the West Chinati stock, at the head of San Antonio Canyon, may host a secondarily enriched zone of copper mineralization at depth.

These and other intrusive bodies located around the margins of the West Chinati stock warrant further study.

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